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SIGNAL PROCESSING UNIT FOR A DIGITAL TV SYSTEM

RELATED APPLICATIONS

This Application is a continuation of International Application No. PCT/DE00/00037, filed January 4, 2000, designating the United States, which claims priority to DE 199 00 136.7 filed January 5, 1999.

The entire teachings of the above applications are incorporated herein by reference.

BACKGROUND OF THE INVENTION

The invention relates to a signal processing unit for a digital TV system.

Digital TV systems differ from the more familiar analog television systems by virtue of the almost exclusive digital processing and conditioning of the picture and sound signals that are transmitted or made available via various media such as satellite, cable, antenna, CD-ROM, DVD, etc. In general, these signals are digitally coded and compressed according to a specific standard (for example DVB-T or MPEG-2 or the like), and optionally encrypted. The systems of this type thus require complex signal processing which, in practice, can only be realized digitally.

SUMMARY OF THE INVENTION

The invention is based on developing a signal processing unit for a digital TV system in such a way that, with relatively little additional outlay, the frame rate can be increased in order to improve the picture impression.

In accordance with an embodiment of the present invention, a signal processing unit comprises a first device for acting on a video signal, for example, by overlaying graphical picture elements and text characters onto the video signal. A second device converts the frame-rate and picture-format of the signal after processing by the first device. The output of the second device is applied to a driver stage for driving a display.

Because frame-rate conversion occurs at the end of the processing chain and, consequently, after all graphics operations, graphics operations can be performed at the lower frame rate, such that the speed requirements of these circuits are not particularly stringent or do not have to be increased. Furthermore, only one circuit is required for frame-rate conversion, which processes the whole signal (that is to say, video picture data overlayed with graphics and/or text data).

Preferably, a common picture storage device is connected to the first and second devices for storing and sharing picture data, minimizing the need for additional components.

Furthermore, at least one input stage receives compressed picture data from at least one transmission medium. Also, at least one decoding unit converts the compressed picture data into digital pixel data of an overall data stream which is fed to the first device.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other objects, features and advantages of the invention will be apparent from the following more particular description of preferred embodiments of the invention, as illustrated in the accompanying drawings in which like reference characters refer to the same parts throughout the different views. The drawings are not necessarily to scale, emphasis instead being placed upon illustrating the principles of the invention.

FIG 1 is a block diagram showing the basic structure of an embodiment of the present invention.

FIG 2 is a block diagram of the embodiment in accordance with FIG 1.

DETAILED DESCRIPTION OF THE INVENTION

A description of preferred embodiments of the invention follows.

In accordance with FIG 1, a signal processing unit, according to the invention, for a digital TV system comprises a plurality of input stages 1 for TV data streams from different sources. This may involve corresponding tuners for reception via antenna, cable or satellite or other input stages for the connection of drives for CD-ROMs, DVDs, etc. In this case, the data streams may be modulated by known digital methods such as QPSK, QAM, COFDM, and optionally compressed using techniques such as MPEG-1, MPEG-2. New transmission standards such as DVB-T, etc., may also be realized.

The input stages 1 are followed by one or more decoding units 2. The decoder units 2 serve, for example, to convert compressed picture data into digital pixel data, and to combine the various individual data streams (picture and sound signal) to form an overall data stream. For this purpose, the decoding units 2 may comprise, for example, an MPEG-2 decoder and various audio signal decoders, e.g. for stereo, surround, etc.

The digital video signal (YUV signal) present at the output of the decoding units 2 is then fed to a first device 3. The first device 3 overlays graphical picture element and text character signals onto the digital video signal. Such processing may involve, for example, Internet browsers or other graphical user interfaces via which interactive communication of the user via a telephone line or the like is possible.

A second device 4 for converting the frame-rate is connected to the output of the first device 3. This second device 4 converts the output signal of the first device 3, which, for example, comprises a frame refresh frequency of 50 (60) Hz, into a 100 (120) Hz picture signal. Frame rate conversion can be done, for example, either by repetition of the preceding picture or by motion estimation and picture interpolation. These two methods are known per se from analog television picture processing.

The decoding units 2 and the first and second devices 3, 4 are connected to a

common picture storage device 5, thereby enabling a significant saving of components. The output signal of the second device is finally fed to a driver unit 6, to which a display is connected.

FIG 2 shows the interconnection of the individual blocks in detail. Three input stages 11, 12, 13 are provided, each of which is adapted to a different program source such as CD-ROM, DVD, satellite antenna, cable, etc.

The output signals of these input stages are fed for example as 50 Hz MPEG data streams to the downstream digital decoding units 21, 22, which are also connected to one another.

The decoded picture signals then pass to the first device 3 for acting on the video signal with the abovementioned graphical picture elements and text characters.

Connected to the first device 3 is the second device 4 for frame-rate conversion in the manner described above, whose output signal is fed to the driver unit 6. A display 6a and also loudspeakers 6b are connected to the driver unit.

FIG 2 also shows the common picture storage device 5, which can be accessed both by the decoding units 21, 22 and by the first and second devices 3, 4.

Beyond merely converting the frame rate, the second device is also capable of freely varying the picture format, using pixel intermediate values stored in the picture storage device, where the pixel intermediate values have been calculated by motion evaluation and pixel interpolation based on preceding pictures.

In particular, in one embodiment, the second device converts the picture scan mode of the incoming video signal from interlaced to progressive scan. Intermediate pictures, calculated by motion evaluation and picture interpolation based on preceding pictures, are retrieved from the picture storage device and reproduced, the intermediate pictures.

While this invention has been particularly shown and described with references to preferred embodiments thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the scope of the invention encompassed by the appended claims.